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What's New, a Report from SIGGRAPH 98

by

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What's New, a Report from SIGGRAPH 98

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SIGGRAPH 98, the 25th annual meeting of the SIGGRAPH society, was held in Orlando the week of July 19. This is the major conference event for the computer graphics community. The conference offers an advanced technical program, a vendor exhibition of over 100,000 square feet, over 40 tutorial courses aimed at participants of various backgrounds, SIGKIDS, an interactive art exhibit, and many other venues. Over 40,000 people attended the conference.

Several members of the [NCSA Visualization and Virtual Environments Team](#) attended SIGGRAPH. We report here on the new technologies presented at the conference. This report is on-line at

<http://www.ncsa.uiuc.edu/Vis/Publications/ISGGRAPH98> .

1 Unix Graphics Systems

SGI, www.sgi.com, announced a number of enhancements to the Onyx2 IR supercomputer, including system configurations of up to 128 processors and 16 graphics pipes, a digital video multiplexer (DPLEX) option, and a new IR2 graphics subsystem. For more info see [SGI's Press Release](#).

HewlettPackard, www.hp.com, demonstrated a system consisting from 3 HP workstations, each equipped with one HP VISUALIZE fx6 graphics subsystem and rendering different views of the same OpenGL scene (think about it as left, front, and right walls in the CAVE). The workstations were connected by a high-speed network allowing (software) synchronization between renderings. HP's benchmarks show that VISUALIZE fx6 outperforms SGI's IR in performance. For more info on HP's graphics:

<http://www.hp.com/unixwork/products/visualizegraphics.html>

<http://www.hp.com/unixwork/hpgraphic/>

SUN, www.sun.com, demonstrated a system with 8 SUN graphics accelerators rendering a scene split into 6 screens. The demo application was written in Java3D(!). This was a technology demo, rather than a product. For more info on SUN's graphics:

<http://www.sun.com/desktop/products/Graphics/elite3d.html>

<http://www.sun.com/desktop/products/Graphics/creator3d.html>

2 SGI's NT Machine

We all know it's coming (before the end of 1998), but there was not a peep out of SGI on this...

3 PC Graphics Systems

SIGGRAPH course #29, "**Developing High-Performance Graphics Applications for the PC Platform**", contained a wealth of information on PC graphics systems. Organizers of this course categorized PC graphic machines into two classes: "consumer" and "workstation". A "workstation" has a graphics accelerator card costing

\$300 or more; "consumer" machines don't.

3.1 Consumer PC Graphics

Gary Tarolli, former SGI flight-simulator developer, and founder of 3Dfx Interactive (makers of the Voodoo graphics board) outlined the following.

System configuration, performance: Games are now typically at 800x600 resolution or higher. Graphic chips are "catching up" to CPU performance. Key has been semi-conductor sizes (increased 40-fold from 50K gates on a graphics chip in 1992 to 2000K gates in 1997).

Predictions: By 1999, we'll see 5-10M tri/sec, bus bandwidth permitting, 300M+ pixels/sec, full-scene anti-aliasing, texture compression < 4 bits. By 2000, we'll see 10M+ tri/sec, 900M+ pixels/sec fill rates.

Innovation: In many areas, PC graphics have copied workstation ideas (i.e. z-buffer, alpha, textures, fog, ...). However, PC graphic technology has "invented" some interesting techniques and methods of implementing graphics, such as multiple textures, low-cost full-scene anti-aliasing, and low-cost high fill rates.

3.2 Workstation PC Graphics

Workstation PC graphics: includes Windows NT and multiprocessor support, is optimized for OpenGL, provides sophisticated windowing support, is high-resolution, supports deep color.

3.3 Products

PC graphic machines contain 3D graphic accelerator boards, which, in turn, contain 3D graphic chipsets. Before evaluating a PC graphics system, one must examine the available 3D graphic accelerator board. Before evaluating a graphics accelerator board, one must examine the underlying 3D graphics chipset. Below, we look at systems, boards, and chipsets.

Lots of 3D graphic accelerator boards are now available. When making comparisons, remember that the information (specs, performance, features) below is directly from the vendor brochures or web-sites. Performance test specs and feature sets often mean different things to different vendors. Finally, the information is in no particular order.

3.3.1 3D Graphic Chipsets

3Dfx Interactive, Inc., Voodoo2, 3M tri/sec, 90M pixel/sec, Connect 2 Voodoo cards for double the fill rate and speed, 3Dfx Glide, OpenGL, Direct3D, Perspective correct texture mapping, Bi and tri-linear filtering, Z-buffer, LOD per-pixel MIP-mapping, Sub-pixel and sub-textel correction, Gouraud shading and texture modulation, Full 24-bit rendering, 14 texture formats, 8-bit compressed and 8-bit palletized formats, 2 to 4 MB EDO DRAM frame buffers, 2 to 4 MB EDO DRAM texture memory, Anti-aliasing, Depth buffering, Alpha Blending, Per-pixel special effects: fog, transparency, translucency, Texture animation, morphing, compositing, Full speed environment mapping, Bump mapping, Detail texturing

3Dlabs, Permedia 2, 1M polys/sec, 42M pixel/sec, OpenGL, Direct3D, Perspective correct texture mapping, Bi-linear filtering, 16 bit Z-buffer, Sub-pixel correction, Gouraud shading, Full-scene anti-aliasing, Alpha blending, Stencil buffer, Per-pixel special effects: fog

3Dlabs, Permedia 3, 8M poly/sec, Direct3D, OpenGL ICD, 32-bit color, 32, 16-bit Z-buffer, Per pixel tri-linear mip-mapping, Full blend modes and alpha tests, Anti-aliasing, Bump mapping, Virtual textures, Voxel rendering, Advanced filtering

3Dlabs, Glint GMX, 2.6M visible, lit meshed tri/sec, 66M pixel/sec, GMX 1000: 1 Glint Gamma geometry processor + 1 MX rasterizer engine, GMX 2000: 1 Glint Gamma geometry processor + 2 MX rasterizer engines, OpenGL, Direct3D (DirectX geometry ready), Gamma processor, 100% OpenGL geometry pipeline in silicon, Full geometry transform processing, Full lighting calculations for 16 lights, Texture coordinate and fog calculations, Hardware clipping and culling, Raster engine, 32-bit RGBA double-buffering, 24 or 32-bit Z buffer, Multi-plane overlays, stencils, and alpha, VRAM framebuffer, EDO DRAM localbuffer, Screen resolutions up to 2048x2048

including HDTV resolution, 100% hardware texture mapping (per-pixel mip-mapping, tri-linear filtering, on-chip texture cache, 8-bit palletized)

3Dlabs, Oxygen RPM (previously of Dynamic Pictures), 4M shaded tri/sec, 120M texture-mapped, mip-mapped pixels/sec, Power-threads for multi-threaded OpenGL, OpenGL, Resolutions up to 1920x1200, 24 bit true color and 24 bit Z-buffer, Accelerated shading, lighting, texture-mapping, Bi, tri-linear texture filtering, Alpha blending with destination alpha support, Multi-plane stenciling and overlay planes, Anti-aliasing through multi-sampling, Transparency, dithering, atmospheric effects

Intergraph, Intergraph Intense 3D Wildcat, 6M shaded, lit, z-buffered, 25 pixel tri/sec, 90M pixel/sec, Provides hardware acceleration of all graphics functions via 3 custom ASIC devices (bus interface, geometry acceleration, rasterization), OpenGL, RenderGL, Direct3D, DirectDraw, 2D GDI, Texture acceleration (point sampled, bi, tri-linear mip-mapping, 32-bit textures, 3D volumetric textures), 32-bit Z-buffer, Per-pixel effects: complex fog, atmospheric effects, Linear, exponential, user-defined fog models, 8 stencil planes, 8 overlay planes

Evans & Sutherland REALimage 2000, Evans & Sutherland REALimage 2000, 4M primitives/sec, 90M pixel/sec, OpenGL, Direct3D, Full OpenGL feature set, Phong and Gouraud shading, Alpha blending, Anti-aliased lines and sorted polygons, Atmospheric effects, Depth cueing, Bi, tri-linear mip-mapping, Scissoring, Subpixel processing, Overlay and stencil planes, Accumulation buffer, Alpha-blended effects: fog, Dedicated texture memory (2 level caching, 32 MB), 32-bit RGBA, double-buffer, 24-bit Z-buffer

nVidia RIVA TNT, nVidia RIVA TNT, 128-bit wide graphics engine and frame buffer, 8M million triangles/sec peak, 250Mpixel/sec fill rate, OpenGL, Direct3D, Optimized Direct3D acceleration, Complete DX5 and DX6 support, Twin texel (TNT) 32-bit graphics pipeline, Per pixel perspective correct texture mapping, 24-bit or 16-bit HW Z buffer (floating point or integer), 8-bit stencil buffer, Anti-aliasing: full scene, order independent, High performance 128-bit 2D Acceleration, Fast 32-bit VGA/SVGA support, 16MB, 8MB and 4MB frame buffer configurations

Intel740, Intel740, 1.1M tri/sec, 45-55M pixels/sec, OpenGL, DirectX, Flat and Gouraud shading, Bilinear filtering mip-mapping, Color alpha blending for transparency, Real-time texture paging and video texturing, Fog and atmospheric effects, Specular lighting, Edge anti-aliasing, Stippling transparency, Backface culling, Z-buffer, Texturing (per-pixel correct, various formats, integrated hardware palette)

Matrox MGA-G200, Matrox MGA-G200, OpenGL, DirectX, Alpha-blending, Bi, tri-linear mip-mapping, Fog, Anti-aliasing, Specular highlights

3.3.2 Graphic Accelerator Boards

<i>Vendor</i>	<i>Product</i>	<i>3D Graphics Chipset</i>	<i>Memory</i>	<i>Price</i>
<u>Intergraph</u>	<u>Intergraph 3D Wildcat 4100</u>	Intense 3D Wildcat		
<u>Elsa</u>	Gloria XXL	3Dlabs Glint Gamma geometry	16MB VRAM + 24/40MB DRAM	\$2249
	Gloria XL	3Dlabs Glint MX + geometry	16MB VRAM, 22MB DRAM	\$1699
	Gloria L/MX	3Dlabs Glint MX + geometry	8MB VRAM, 16MB DRAM	\$1099
	Gloria Synergy	3Dlabs Permedia2	8MB RAM	\$149
	Erazor II	NVidia RIVA TNT	16/8MB RAM	TBD
	Erazor	128-bit engine	4/8MB	\$79
<u>Real3D StarFighter</u>	<u>Real3D StarFighter</u>	Intel740 chipset	4/8MB SGRAM	\$83 - \$220

<u>AccelGraphics</u>	AccelSTAR II	3Dlabs Permedia2	8MB SGRAM	??
	AccelPRO MX	3Dlabs Glint MX	8MB framebuffer, 16MB local, texture	??
	AccelGMX 2000	3Dlabs Glint GMX 2000	16MB framebuffer, 80 MB local, texture	??
	AccelECLIPSE II	E&S REALimage 1000	16MB framebuffer, 4/16MB texture	??
	AccelGALAXY	E&S REALimage 2000	20MB framebuffer, 16/32 MB texture	??
<u>Real3D Oxygen RPM</u>	<u>Real3D Oxygen RPM</u>	Oxygen chipset	32, 64, 128MB	??
<u>Quantum3D</u>	Obsidian2 Consumer	Voodoo2 chipset	16/24 MB Memory	\$320 - \$700
	Obsidian2 Professional	Voodoo2 chipset		??
<u>Diamond</u>	Monster 3D II	Voodoo2 chipset	8/12MB	\$230 - \$280
	Fire GL 1000 Pro	3Dlabs Permedia2	8MB SGRAM	\$150
	Fire GL 3000	3Dlabs GLINT texture graphics + geometry	8MB VRAM to 32MB EDO DRAM	\$800
	Fire GL 4000	Mitsubishi + E&S Realimage	15MB 3DRam	\$2400
	Fire GL 5000	E&S Realimage 2100	20MB 3DRam	??
<u>Matrox</u>	Millennium G200	Matrox MGA G200	8/16MB	\$165
<u>STB</u>	Glyder GMX-1000	3Dlabs GLINT GMX1000	16MB VRAM, 40MB DRAM	??
	Glyder GMX-2000	3Dlabs GLINT GMX2000	16MB VRAM, 80MB DRAM	??
<u>Leadtek</u>	WinFast 3D L2520	3Dlabs GLINT MX	24MB	??
	WinFast 3D L2530	3Dlabs GMX1000	24MB	??
	WinFast 3D L3100	3Dlabs GMX2000	96MB	??
<u>MaxVision</u>	Titan II	3Dlabs GMX2000	16MB VRAM + 80MB DRAM	??

3.3.3 Some Workstation PC Systems

For a flavor of high-end workstation PC's, below is a sample of a few configurations with graphic accelerators, memory, and pricing. These were chosen at random and obviously represent a much greater audience of configurations and vendors.

<i>Vendor</i>	<i>Processor</i>	<i>Graphic Accelerator</i>	<i>Memory</i>	<i>Price</i>
<u>Hewlett-Packard Kayak</u>	400Mhz Pentium II, Dual-	Visualize fx4 (HP)		\$11,779

	processor support			
<u>NTSI</u>	400Mhz Pentium II, Dual-processor support	TitanII	128MB - 1GB	\$5000 - \$10,000
<u>Tri-Star Computer</u>	400Mhz Pentium II, Dual-processor support	ELSA Gloria XXL	384MB	\$11,500
<u>Tri-Star Computer</u>	400Mhz Pentium II	AccelECLIPSE II	256MB	\$6000
<u>Tri-Star Computer</u>	400Mhz Pentium II	Oxygen	128MB	\$5000
<u>Core Microsystems</u>	350Mhz Pentium II, Dual-processor support	3Dlabs GMX2000	128MB	\$6695
<u>Dell</u> "Siggraph show special"	400Mhz Pentium II	Intergraph Intense 3410GT	128MB	\$9000

3.3.4 Other Products

Mitsubishi 3D-Ram The new Mitsubishi 3D-RAM is an innovative frame buffer memory architecture optimized for high-performance 3D graphics that provides approximately 3 to 4 times increase in rendering performance. Designed for high-performance workstation and personal computer applications, the 3D-RAM increases the data transfer rates by integrating key functions on-chip, including an arithmetic logic unit (ALU), to accelerate Z-buffer rendering and on-chip caches.

PixelFusion In development of a series of processors using a term they call FUZION. FUZION combines massively parallel rendering and sub-pixel programmability in a new scalable architecture. FUZION will be launched mid 1999 priced for high-end PC NT market. They claim the following: 11M tri/sec (peak), 1 M anti-aliased, true phong shaded, bump mapped, mip-mapped tri/sec (sustained), Anti-aliasing with sub-pixel Z-buffer, Programmable pixel shading delivering features such as true Phong shading and bump mapping in real time, Optional geometry, OpenGL and Direct3D compliant, Advanced rendering techniques can be programmed (i.e. volumetric)

Real3D PRO-1000 Image generators or graphics peripheral designed to be connected via an SCSI II interface and driven by a user-selectable host computer. The unit was formed as a separate entity to leverage and commercialize real-time graphics technology developed by Lockheed-Martin for high-performance combat simulators. Features, performance include: 1M textured, shaded, translucent, anti-aliased, fogged poly/sec, built-in fog and shading, illumination lobes, database culling, 32MB texture memory

4 Stereo Displays

Wider FOV HMD Kaiser has a Head-Mounted Display (ProView 80) that offers 80 degrees FOV with 100% overlap or 112 degrees. It costs \$35,000. I tried it and the FOV was quite impressive. Other than that though, it's just like any other HMD.

Nice binocular display, n-Vision, www.nvis.com I particularly liked their binocular format display. It was very intuitive to use and felt more natural than having a big thing attached to my head.

Unencumbered Stereo. The **Dresden 3D (D4D)** 21" flat-panel plasma auto stereo monitor. (<http://kastor.inf.tu-dresden.de/D4D/>) This was cool. No glasses needed, so it allowed for totally unencumbered stereo display at the desktop. He was using two cameras to ascertain where the viewers eyes are, and adjusted the parallax based on that reading. The left and right eye images are displayed simultaneously in alternating columns, and then a prism grating is used to ensure that each eye sees the correct view. Even columns go to the left eye, and odd columns go to the right. It took a very short period of time for the image to "pop" for me, and then it was very effective. It worked very nicely for rotations, animations, etc. If you translate your head horizontally it took another brief time for the image to work correctly again. You had to sit the right distance from the monitor. It is truly a one person device. If you looked while someone else was doing it it didn't do well at all. They have two prototypes and are looking for application development partners as well as partners to produce the device. He claims they can make copies of the prototypes in short order.

ChromaDepth 3D This is a way to create 3D images with "normal" look without the glasses, but jump into 3D with the glasses. Though this particular item may not have much value in scientific visualization, but it is an interesting

item for toys and for entertaining purpose. The lenses create the stereo illusion by shifting the image colors in different direction for each eyes. The depth is encoded by the color and decoded by the optics.

The choice of the background color determines the colors should be used to achieve the 3D effect. If black background color is choosed, for example, objects in red color will appear closer to the eyes and objects in blue color will be the most background objects. For more information, <http://www.chromatek.com>

Virtual Head, echtzeit GmbH, Berlin, www.3dmedia.com, Designed to enhance communication in virtual environments and telepresence. It renders a 3D images of every conference partner in real time. The head movements are captured by a tracing system. Compressed video and audio information are exchanged via a high band-width network.

3D Display System, Sanyo Multimedia Center USA, toobase@aol.com, Overlaid with double image splitters behind and in front of, images on the LCD panel are separated to supply crosstalk-less 3D images without special glasses. A head-tracking system expands the stereoscopic area without special attachment to viewer

High Definition Volumetric Display (HDVD), Dimensional Media Associates, Inc., www.3dmedia.com, This patented technology produces true 3D aerial images without using lasers and without requiring users to wear special eyeglasses or VR headsets. This is a device that might benefit scientists in visualizing their data in a different way. I will look into this device more closely.

5 Projection Systems

Barco - <http://www.barco.com> Barco had a wide assortment of products interlaced throughout the entire showroom floor. The Baron, High-Performance Projection Table, was featured in the Trimension Booth. The Baron is a reasonable substitute for an Immersadesk and can handle the "coffee-mug-holding needs" which the workbench provides. Apparently, Dan Doolan, the audio-visual guy at UIUC, has already established a relationship with Barco representatives. The RetroGraphics 808s, though not a VR display system would be nice for a portable tele-presense facility.

Electrohome - <http://www.electrohome.com> As opposed to Barco, Electrohome had virtually no official presense at SIGGRAPH, even though they too had projectors all over the conference. No product literature could be found and it is interesting how Electrohome chooses to remain a behind the scenes player at SIGGRAPH. However, see Fakespace below...

VREX - <http://www.vrex.com> VREX had a very impressive display of 3D stereoscopic LCD projectors. The stereo was passive, but this didn't diminish its effect when viewed from a wide angle. Though the VR-2100 appears to only support PC and Mac platforms, I would guess that an O2 could fit into the scenario. The VR-2210 claims to support only PC and Mac platforms also -- however, the sales reps confessed to the possibility of a 13w3 connector cable which could imply connectivity to an SGI workstation.

Pyramid Systems - <http://www.pyramidsystems.com> Pyramid seems to have survived losing over half of its personnel to Fakespace and Carpenter. The CAVE they installed for the Ars Electronica application was very clean. Though, I am puzzled by the new look of placing the transmitter flush to the supporting unistrut. I was even more dumbfounded to return to NCSA and notice that the transmitter in our own CAVE was mounted the same way! When did that happen? Anyway, The Pyramid Booth displayed both the Idesk2 and "classic" Idesk1. There's a great picture of their MindzEye system in their glossy brochure. The picture was taken at the SGI Detroit facility which is definitely worth a visit.

Trimension - <http://www.trimension-inc.com> Trimension, the new kid on the block, is a VR integrator company. Middlemen extraordinaire, they apparently have little problems crossing petty political boundaries mixing and matching products without a care and renaming them to suit their needs. For example, the V-desk5 is basically a Barco Baron. The Relocatable Reality Room product was on display at their booth and in the Digital Pavillion area. They were doing some edge blending on their wall and when I asked them about [Panoram](#) systems several of the reps. converged on me declaring Panoram their sworn enemy/competitor and that their edge-blending system was far superior in that the coverage area of the blend was much smaller. Panoram, like Electrohome, seems to care less about the SIGGRAPH conference. When I queried them about [SEOS](#), they confessed that SEOS was their sister

company. Well, that is somewhat like saying Microsoft is a sister company to Softimage! Obviously, Trimension is major thrust effort by SEOS.

TAN - <http://www.tan.de> TAN makes its US debut with a very sparse booth. It was nice to get my hands on a physical brochure of their products as opposed to browsing their Web site. Their Holobench looks really cool and their Tanorama is a complete steal of the Panoram wall. It seems that there are more VR companies than VR products now!

Fakespace - <http://www.fakespace.com> Faekspace showed a new version of the Immersive Workbench. This was VERY nice, featuring a bright display and passive stereo. The brightness is due to using two projectors for an immersa-desk sized display... they both fit nicely inside the case. The passive stereo looked good and used circular polarization so that when you turned your head sideways you didn't lose the stereo effect. Some people did experience some ghosting.

6 Tracking Technologies

7 Multimodal Interfaces

7.1 Audio

Sound Dome Brown Innovations demonstrated their "Localizer" sound dome, which provides clear audio to the person standing under the dome. The sound fades away very rapidly when the person steps away from the dome. This provides a localized sound presentation without disturbing others in the same room. For more details, you can visit their Web site at <http://www.purestereo.com>

7.2 Commercial Haptic Devices

HAPTECH

The hapttech product (<http://www.hapttech.com>) was an interesting pen based force feedback device. In practice it is sort of like a two-dimensional case of the Phantom. It provides input information of where the pen is positioned and provides force back to the participant according to where the pen is positioned. They do not currently have plans for a three-dimensional device. They are looking for application developers. My first impression is that this device could be useful for aiding in universal access to web pages, and / or two-dimensional imagery. I can also envision a number of educational applications. They are planning the list price to be \$695.00.

CyberGrasp - Virtual Technologies Inc.

The cybergrasp glove (www.virtex.com) is the one that does force feedback by attaching rings to your fingers, and then pulling on the rings via speedometer type cables. Bill Sherman showed a video of this device at a group meeting once.

I tried the cybergrasp out and it was very interesting. Unfortunately it does not provide a fingertip tactile sensation, so I got more the impression of someone trying to prevent me from grasping something rather than that I was grasping something. I think this is a step in the right direction. Bill took some video of me using this device.

FEELit Mouse (www.immerse.com) The Feelit mouse is a mouse that does force feedback and vibrations in two dimensions. They are releasing it to developers. I got them to give me the documentation for their API. They are looking for developers. I thought it would be good for universal access to web pages and images, as well as educational applications (e.g., physics). This will list for \$140.00 when released.

7.3 Research Haptic Devices

Haptic Screen, University of Tsukuba (Japan), intron.kz.tsukuba.ac.jp A projector located above a elastic screen which has an array of 6x6 linear actuators beneath it. Each actuator has force sensor that responds to the force applied by the user. Image of virtual object is projected on the elastic surface so that the user can directly touch the

image and feel rigidity.

Foot Interface: Vibration Slippers, Tokyo Institute of Polytechnics, <http://lapalce.photo.t-kougei.ac.jp> A research project by Tokyo Institute of Polytechnics, this interesting device allow a user to step on virtual roaches projected on the floor and feel the vibration.

SPIDAR: Spatial Interface Devices, Tokyo Institute of Polytechnics, msato@pi.titech.ac.jp Connected with cable, pulley and motor, a user can move with the cube space to "push" (and feel the feedback force) the virtual objects

7.4 Other Novel Input Devices

TouchCube, ITU Research, Inc. www.ituresearch.com The TouchCube was a device for doing 6DOF input to a workstation or other device. It was a cube that had surfaces like the old macintosh touch panels on the laptop. By touching the various sides of the cube and sliding your fingers you can do fairly intuitive manipulations. By pressing on different panels simultaneously you can put the device into different modes. It seems like it would take some learning, but seemed to have potential as a 3D input device. He had not set a price yet.

WACOM Wacom was showing a pen based input tablet that displayed on the tablet itself, thus allowing one to draw and write intuitively. It was a very thin tablet like a wacom tablet, but it displayed the computer screen right on the tablet. The PL-300v LCD display tablet is \$2499.00

Virtual 3D Technologies Corp www.virtual3Dtech.com They had a 3D scanner they were showing that used just one camera to make the 3D mesh.

MicroScribe-3D IMMERSION Corporation www.immerse.com This was a 3D digitizing device that looks sort of like a Phantom. \$1995.00

LipsInk, GANYMEDIA www.ganymedia.com This was a device you wore on your head that puts a camera in front of your lips and does image processing to read the shape of your lips. They were showing it as a device to make characters lips animate correctly and easily. I was thinking it could be used for lip reading for universal access, or as an aid to speech input (give the speech recognizer extra information) Unfortunately, it currently requires the user to paint their lips blue.

Pointing/ Input Devices Dr. Sibert at George Washington University presented his finger-mounted pointing device. This device emits signals to the sensors mounted on the frame of a display. The focus position is calculated based on the signals gathered from these sensors on the frame. It gives relatively accurate position at optimal distance. However, this research device is still not for practical usage as the accuracy drops dramatically when the finger is moving close or away from the optimal distance. Also, it may cause fatigue problems when wearing such a device on the finger for typing and pointing. For more information, please visit Dr. Sibert's web site: <http://www.seas.gwu.edu/faculty/sibert>

7.5 3D Geometry Scanning

There are many interesting approaches on scanning 3D geometry into manipulatable computer models. Some use laser technology, some use images from video/ camera, and some use touch probes. There were quite a few vendors in the SIGGRAPH 98 exhibition area promoting their scanning equipment, including:

Roland DGA Corporation PICZA Digitizer, Touch Probe, www.rolanddga.com, Lower cost, slow, lower accuracy

Gentech Gen-Trix, Camera, www.gen.co.jp, Lower cost, slow, more tedious

Gentech CitiBuilder, Camera, www.gen.co.jp, Based on series of aerial photos of a city and position data for several points of the target object, creates a 3D city model

Real 3D, Inc., Camera/Laser, www.real3d.com, Higer cost but fast

Virtual 3D Technologies Corp., Camera, www.virtual3dtech.com, Reasonable cost and speed but the unit is

comparably larger than others.

Cyberware, Camera/Laser, www.cyberware.com, Prices ranging from \$23K to \$410K based on the models. Fairly fast scanning speed

Immersion Corp. MicroScribe-3D, Touch Probe, www.immerse.com, Prices ranging from \$3K to \$5K based on the models. Slow and more tedious

Geometrix, Inc., Camera, www.geometrixinc.com, Price around \$10K. Reasonable scanning speed.

Sanyo Electric Co., Ltd. CyberModeler, Camera, www.sibdaily.com, Slower, works for only convex geometry. Concave geometry is still under work.

Polhemus Inc., Laser, www.polhemus.com, Fast, hand-held

Visual Interface, Inc., Camera, www.visint.com, Fast, hand-held

7.6 Milling Machines

3D Bit Cube - GENEX www.jikuhanso.com/3DBC/index.html While not actually a milling machine, the 3D Bit cube was interesting. It allowed you to create an artwork in a cube of glass (?) from a 3D model. It caused a tiny crack at the point where two laser beams intersect. The resulting cuttings in the glass cube were very beautiful.

8 Graphics Software

8.1 Java3D

Java3D is currently available for Solaris and Windows NT. Java3D includes support for 3D graphics, for 3D localized sound, and for animation through the use of sensors and engines. Support for multiprocessor and multipipe systems is included in the design. For example, a Java3D scene graph has no guaranteed traversal order -- each path from the root to any node can be rendered independently of all others. Considerable attention is being given to performance -- automatically optimizing the scene graph, etc.

When will we see it on an SGI? Java3D relies on JDK 1.2, and SGI does not yet offer 1.2. Otherwise, it should be fairly straightforward to port Java3D to IRIX. Both the Java3D technical crew and the SGI technical crew all expressed eagerness to see this happen.

NCSA's Steve Petrowicz won the Java3D award for best application. Surprisingly, the Java3D demos at the Sun booth weren't very good.

8.2 VRML

Unlike the last couple of years, there were **no** booths on the floor emphasizing VRML. Many products make use of VRML in one way or another, but no one was waving the VRML flag or making a big deal about it.

We did see a nice module for loading VRML 2.0 into Performer nodes. This comes from OpenWorlds.

8.3 Performer, Fahrenheit

IRIS Performer SGI reiterated its commitment to Performer. Latest release of IRIS Performer is 2.2.2. By the end of '98 we will see r.2.2.3. New features will include double-precision Xform nodes and DPLEX support.

Performer will NEVER run on NT. After the year 2000 and full release of Fahrenheit, Performer will go into support mode with no future development. There is a number of products that are written on top of IRIS Performer and perform visual simulations in CAVE-like systems: [pfCAVE](#), AVOCADO, [dVISE](#).

Fahrenheit

Fahrenheit is a collaboration between Silicon Graphics and Microsoft to create a high-performance graphics architecture. It comprises the following three components:

- Fahrenheit Low Level API (FLL): will support both OpenGL and Direct3D.
- Fahrenheit Scene Graph API (FSG): similar to Performer and Open Inventor scene graph. This is the most significant API;
- Fahrenheit Large Model Visualization API (FLM): Future OpenGL Optimizer. Fahrenheit design review is underway, alphas of FLL & FSG are due by winter '98-'99, FSG 1.0 is due by summer '99.

8.4 Geometry Manipulation Software

There were several vendors demonstrating geometry manipulation software. Most of these software are intended for artists to do animations. However, the underlying technology for most of these software are based on NURBS (Non-Uniform Rational B-Spline) formulations. NURBS is a scalable mathematical representation that can be used to represent curves, surfaces, volumes, or beyond the fourth dimension. NURBS is a well-researched topic and references/books for it can be found easily.

Most software offer the ability to import a geometry model or a set of points. The imported data can be converted to a set of control nets which allows the user to manipulate the geometry without losing the fidelity of the geometry definition.

Other than the bundled software that come with scanning hardware, the following vendors offer such software separately:

Rhinoceros, Robert McNeel & Associates, www.rhino3d.com, \$800 (NT/Win95)

ParaForm, ParaForm, www.paraform.com, Price unknown

8.5 High-quality Rendering (RenderMan)

New version of the RenderMan Toolkit (v 3.8) is due the second week of August. New features described at SIGGRAPH included:

- Subdivision surfaces. A type of cross between polygons and nurbs, these new surface representations are becoming extremely popular. Using wavelets, surfaces can be represented continuously for such operations as smooth level-of-detail transitions, multi-resolution editing, and controllable creasing. The Pixar short, Geri's game, was done using subdivision surfaces.
- DSO capability. An extremely useful new feature is the ability to write C/C++ functions as dynamic shared objects. These DSO's are read in by the renderer when called. With this feature, developers are no longer restricted by the interpreted shading language.
- New Types (Vector, Normal, Hpoint, Matrix) and new primitives (point and curve)
- Multi-segment motion blur (piecewise linear segments)
- Message passing. Shaders can look at other shader's attributes and parameters using a type of blackboard communication scheme (one shader posts information to the board, other shaders can retrieve information about that shader from the board).
- Pixar Renderman with Blue Moon Toolkit. The author of Blue Moon Rendering Toolkit (BMRT), Larry Gritz, showed an interesting technique to use both renderers in a common scene. BMRT can be used to render elements when called from the Pixar renderer. In this way, BMRT can be used to reflect, refract, shadow with

ray-casting, or other techniques not implemented by the Pixar Renderman implementation.

- Alias Maya to Renderman integration (MTOR). This integration is "tighter" than ever before and as a plug-in to the Maya system offers more functionality from Renderman in an existing Alias Maya scene. Renderman shaders are easily attached to Maya elements and other Renderman tools such as the distributed render manager (Alfred) are coupled to allow for a seamless working session. In this way, Maya can be used for modeling and animation while Renderman and shaders can provide the rendering.

8.6 Renderman Hardware

Advanced Rendering Technology: RenderDrive. (<http://www.art.co.uk>) This was a rack mounted box that did hardware raytracing using the Renderman spec from Pixar. There were some VERY impressive images that they showed including effects like radiosity, soft-shadows and depth-of-field blurring. They compared the images to the same ones rendering in 3DSmax, Maya, Bryce3D, etc. The times were impressive. Images computed with standard software systems were on the order of 30-40hrs while the RenderDrive image took 12 mins.

9 VR Software

9.1 CAVELib update

Pyramid Systems has the rights to distribution of the CAVELib software. VRCO was recently formed by members of the Electronic Visualization Lab, University of Illinois, Chicago. Pyramid has contracted with VRCO for future development of the CAVELib. It was announced at SIGGRAPH that the CAVELib would be modified such that license checking would be disabled for educational sites.

9.2 OpenGL Optimizer

Latest release is 1.1. There will be a new patch before the end of '98. After FLM 1.0 (Fahrenheit Large Model) is released, there may be one more release of OpenGL Optimizer, probably in March '99. OpenGL Optimizer 2.0 is FLM 1.0! Prosolvia's Oxygen is an example of a VR rendering application developed on top of OpenGL Optimizer that can be run in a CAVE-like system.

9.3 WorldToolKit, WorldUp, and World2World

WTK is a software development system for building high-performance, real-time, integrated 3D applications. The latest release of WTK is R8. Runs on SGI, Sun, HP, DEC, Intel. SGI MP version of WTK can be run in a CAVE-like system. WorldUp is a 3D development environment with integrated modeler. The latest release is R4. Runs on PC and SGI only. No plans to support CAVE-like systems. World2World is a client/server based networking application which integrates with WorldToolKit and WorldUp to enable creation of multi-user 3D/VR simulation applications.

10 Vis Software

10.1 VTK

At the VTK BOF, VTK developers reiterated that GE supports VTK as a freeware effort, and that the developers have no intention of making it a commercial-only product. This open-handed statement was refreshing! KitWare, the VTK company, is intended to make its money from books and support services.

VTK 2.1 is updated nightly at <ftp://ftp.kitware.com/kitware> They run nightly validation checks on it which include using something like purify to check for memory leaks and using a set of validation tests to assure that the algorithms are producing the same results.

Interesting new feature: reworked the wrapper generator that generates the Java and TCL bindings to make it easy to reuse for any language or any purpose.

11 Favorite Quote

Dr. Krzysztof Lenk, quoting St. John of Damascus:

"All images reveal and make perceptible those things which are hidden. For example, man does not have immediate knowledge of invisible things, since the soul is veiled by the body. Nor can man have immediate knowledge of things which are distant from each other or separated by place, because he himself is circumscribed by place and time. Therefore the image was devised that he might advance in knowledge, and that secret things might be revealed and made perceptible."